

6. WHAT IS CLAIMED IS:

1. A display apparatus comprising:

a front substrate on which a fluorescent material is provided;

a rear substrate disposed opposite to said front substrate and having a plurality of electron emission devices laid out thereon to form a matrix, each of said electron emission devices radiating electrons to said fluorescent material; and

a driver capable of applying two or more driving voltages sequentially, which are generated on the basis of an input video signal and have levels independent from each other, during a select period to at least one row of specific electron emission devices selected among said electron emission devices.

2. A display apparatus according to claim 1 wherein:

said input video signal is a digital video signal;

and

said two or more driving voltages are generated on the basis of a digital signal obtained as a result of converting the bit count of said digital video signal.

3. A display apparatus comprising:

a rear substrate including:

a plurality of scanning electrodes extended in

a screen horizontal direction;

a plurality of signal electrodes extended in a screen vertical direction; and

a plurality of electron emission devices placed at intersecting points of said scanning electrodes and said the signal electrodes, each of electron emission devices emitting electrons;

a front substrate disposed opposite to said rear substrate and provided with a fluorescent material emitting light due to electrons radiated thereto by said electron emission devices;

a scanning driver for applying to said scanning electrodes a select voltage for selecting at least one row of specific electron emission devices selected among said electron emission devices during a predetermined select period; and

a signal driver for applying to said signal electrodes a driving voltage having a level depending on an input video signal for driving said electron emission devices;

wherein:

the duration of said select period is determined by the output period of said select voltage; said select period is divided into a plurality of sub-periods; and said driving voltage is applied in each of said sub-periods.

4. A display apparatus according to claim 3 wherein the level of said driving voltage applied to said signal electrodes is changed for each of said sub-periods.

5. A display apparatus comprising:

a plurality of scanning electrodes extended in a screen horizontal direction;

a plurality of signal electrodes extended in a screen vertical direction;

a screen on which a plurality of display devices are placed at intersecting points of said scanning electrodes and said signal electrodes to form a matrix;

a scanning driver for applying to said scanning electrodes a select voltage for selecting at least one row of specific display devices selected among said display devices during a predetermined select period; and

a driving signal generator capable of generating first and second driving signals, which have values independent from each other and each serve as a signal for driving said display devices, on the basis of an input video signal;

wherein:

the duration of said select period of said row of specific display devices is determined by said select voltage generated by said scanning driver; and in said select period, driving voltages obtained on the basis of

said first and second driving signals generated by said driving signal generator are applied consecutively to said signal electrodes.

6. A display apparatus comprising:

a plurality of scanning electrodes extended in a screen horizontal direction;

a plurality of signal electrodes extended in a screen vertical direction;

a screen on which a plurality of display devices are placed at intersecting points of said scanning electrodes and said signal electrodes to form a matrix;

a scanning driver for applying to said scanning electrodes a select voltage for selecting at least one row of specific display devices selected among said display devices during a predetermined select period;

a driving signal generator capable of generating first and second driving signals, which have values independent from each other and each serve as a signal for driving said display devices, by conversion of the bit count of an input digital video signal;

a switch for outputting said first driving signal generated by said driving signal generator during a first period for the select period determined by an output period of the select voltage generated by said scanning driver and outputting said second driving signal generated by said

driving signal generator during a second period for the select period determined by an output period of the select voltage generated by said scanning driver; and

a D/A converter for converting said first and second driving signals output by said switch into analog signals and for applying the analog signals to said signal electrodes as first and second driving voltages respectively.

7. A display apparatus according to claim 6 wherein: said display device includes an electron injection device for injecting electrons and a light emission layer for emitting light due to electrons (or holes) radiated thereto from said electron injection device; and

the number of electrons (or holes) radiated by said electron injection device is controlled by the select voltage applied to said scanning electrode connected to said display device and the driving voltage applied to said signal electrode connected to said display device.

8. A display apparatus according to claim 6 wherein the duration of said first sub-period is made different from the duration of said second sub-period.

9. A display apparatus according to claim 6 wherein: the duration of said first sub-period is made shorter than the duration of said second sub-period; in an operation to produce a dark gray-scale display,

gray-scale control is executed so as to set said second driving voltage applied in said second sub-period at a fixed level of no light emission and vary said first driving voltage applied in said first sub-period; and

in an operation to produce a bright gray-scale display, gray-scale control is executed so as to set said first driving voltage applied in said first sub-period at a fixed level of a substantially maximum light emission and vary said second driving voltage applied in said second sub-period.

10. A display apparatus according to claim 6, further comprising an extraction circuit for extracting characteristics of said input video signal, wherein the durations of said first and second sub-periods or ranges of said driving voltages applied in said sub-periods are changed in accordance with characteristic extraction results output by said extraction circuit.

11. A display apparatus according to claim 6, further comprising a brightness or contrast setting unit, wherein the durations of said first and second sub-periods or ranges of said driving voltages applied in said sub-periods are changed in accordance with a brightness or contrast set value.

12. A display apparatus according to claim 6 wherein said driving signal generator is a gray-scale correction

circuit having a function to correct a gray-scale characteristic's discontinuity caused by a combination of said first and second driving voltages applied in said first and second sub-periods respectively.

13. A display apparatus according to claim 6 wherein said driving signal generator generates said first and second driving signals by converting said digital video signal into a signal having a bit count greater than the bit count of said digital video signal.

14. A display apparatus according to claim 6 wherein the sum of the bit counts of said first and second driving signals generated by said driving signal generator is greater than the bit count of said digital video signal.

15. A display apparatus according to claim 6 wherein the bit counts of said first and second driving signals generated by said driving signal generator are each equal to the bit count of a digital signal that can be handled by said D/A converter.

16. A display apparatus according to claim 6 wherein said scanning driver outputs a select voltage for selecting two rows of said display devices at one time in a sequential scanning operation carried forward in said screen vertical direction.

17. A display apparatus according to claim 6 wherein said scanning driver outputs a select voltage for selecting

two rows of said display devices at one time in a sequential scanning operation carried forward in said screen vertical direction in such a way that a select period of one of said two selected rows does not completely coincide with a select period of the other selected row.

18. A display apparatus according to claim 6 wherein said scanning driver outputs a select voltage for selecting at least one row of said display devices located on the upper half side of said screen and at least one row of said display devices located on the lower half side of said screen.

19. A signal driver employed in a display apparatus, said apparatus having a plurality of scanning electrodes extended in a screen horizontal direction; a plurality of signal electrodes extended in a screen vertical direction; a plurality of display devices placed at intersecting points of said scanning electrodes and said the signal electrodes; and a screen comprising said display devices laid out thereon to form a matrix; wherein said signal driver used for applying a driving voltage for driving said display devices to said signal electrode, said signal driver comprising:

an n-bit gray-scale signal input terminal for inputting an n-bit gray-scale signal where $n \geq 8$;
a sub-period select signal input terminal for

inputting a sub-period specification signal for specifying one of m sub-periods obtained as a result of dividing a select period of said scanning electrodes where $m \geq 2$;

an output circuit for outputting k voltage levels where $k \leq (\text{the } n\text{th power of } 2)/m$; and

a signal converter for selecting one of said k voltage (or current) levels on the basis of said n -bit gray-scale signal and said sub-period specification signal.

20. A display apparatus comprising:

a rear substrate including:

a plurality of scanning electrodes extended in a screen horizontal direction;

a plurality of signal electrodes extended in a screen vertical direction;

a plurality of electron emission devices placed at intersecting points of said scanning electrodes and said the signal electrodes, each of said electron emission devices emitting electrons;

a front substrate disposed opposite to said rear substrate and provided with a fluorescent material emitting light due to electrons radiated thereto by said electron emission devices; and

spacers placed between said rear substrate and said front substrate to create a space between said rear substrate and said front substrate;

wherein:

each specific one of said scanning electrodes is connected to two rows each comprising a group of specific electron emission devices;

said two rows each comprising a group of specific electron emission devices are connected respectively to two different ones of said signal electrodes; and

each of said spacers is located substantially at the center of said two rows each comprising a group of specific electron emission devices on said specific scanning electrode.

21. A display apparatus according to claim 20 wherein:

each two specific ones of said spacers are erected on different ones of said scanning electrodes to create a box-like configuration in conjunction with support members allowing said two specific spacers to support each other; and

the upper sides of said support members are placed at positions lower than the tops of said specific spacers and the lower sides of said support members are floated above the bottoms of the spacers at an altitude at least equal to the thickness of each of said scanning electrodes.